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The Rise and Fall of Milltown's Rice Lake

By Sandy Engel
Stanley A. Nichols

Introduction

Take a shallow lake bordered with wild rice. Add wastewater, sprinkle with bullheads, garnish with beavers and muskrats, and stir with wind. You now have a recipe for disaster and a portrait of Milltown's Rice Lake.

Wild rice (*Zizania aquatica* and *Z. palustris*) once bordered many shallow lakes in Wisconsin. But growing only from seed, young rice plants can become shaded by turbid water and floating-leaf plants. Its shallow roots are no match for strong winds and rising waters. That's how wild rice disappeared from many lakes (Aiken et al. 1988).

When rice disappears, shallow lakes become windswept and turbid. Waves scour the bottom, suspending sediment and nutrients that fuel algal blooms. Seeds, tubers, and root stocks of wild rice and other plants disappear. Soil and nutrients washing off the land no longer are trapped by wild rice and so increase water turbidity.

Restoring shallow, windswept lakes like Rice Lake requires a joint research-management effort: research to understand how growing conditions changed and management to restore the lakes's former vitality. In 1987 the Wisconsin Department of Natural Resources launched a demonstration project on Rice Lake as part of its Shallow Lakes Initiative, which focuses on restoring aquatic habitat in Wisconsin to improve fish, wildlife, and water quality (Engel 1988).

At Rice Lake we're planting wild rice, controlling muskrats, and stabilizing water levels as part of this initiative. In this article we trace Rice lake's past to show how a recipe for disaster can develop and what can be done to restore the lake.

A Century of Wild Rice

Milltown's Rice Lake is a glacial pothole in Wisconsin's Polk County, less than 100 km (60 miles) northeast of St. Paul, Minnesota. Surrounded by cattail-alder marsh, the lake covers 52 ha (128 acres) and is just 1.8 m (6 ft) deep (Engel and Nichols 1991). Rice Creek

A mature wild rice plant, with flower stalk and shallow roots.

runs through the lake and marsh, washing fertile water (mean total phosphorus 150 $\mu g/L$) a few kilometers downstream to 1,900-acre (769-hectare) Balsam Lake.

Surveyors in 1853 pictured Rice Lake amid lightly wooded uplands and marshy lowlands crossed by sluggish streams. Pollen grains buried under 50 cm (20 inches) of Rice Lake sediment provide a record of vegetation for this period. The pollen indicates uplands of oak (*Quercus*) and birch (*Betula*) and lowlands of sedges (Cyperaceae) and cattails (*Typha*). The lake grew varied floating-leaf and submersed plants, including pickerelweed (*Pontederia*) and quillwort (*Isoetes*) that inhabit clear water and firm bottom (Winkler 1989). Wild rice grew profusely here as well. The lake supported a varied fishery dominated by largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), and northern pike (*Esox lucius*).

Towns and farms--linked by roads, stagecoach, and railroad--checkered the land by 1900. Pollen grains buried above 50 cm of sediment show fewer trees and more herbs, as ragweeds (*Ambrosia*) and grasses (Gramineae) spread into cleared land (Fig. 1).

Logging and farming brought a sawmill and a creamery that became the site of Milltown Village in 1910. A cannery was added in 1926.

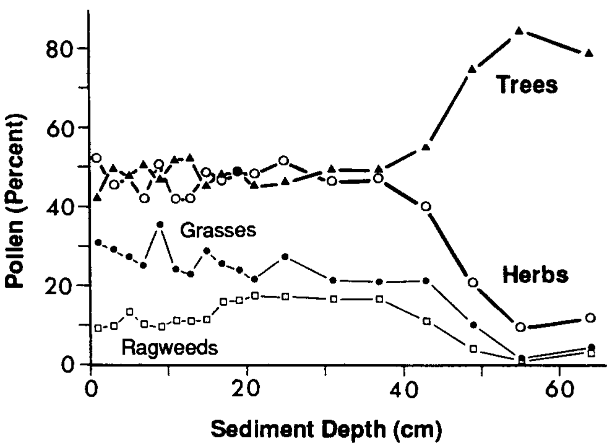

Figure 1. *Pollen remains from Rice Lake sediment sampled on 20 September 1988, showing a change from trees to upland herbs, mainly grasses and ragweeds. Redrawn from Winkler 1989.*

Pollen grains above 20 cm (8 inches) of sediment show spread of cultivated grains with modern farming. The village meanwhile grew from 250 people in 1910 to 634 by 1970 and has over 780 people today.

Such industry and growth led to increased solid waste and wastewater. Solids were dumped in fields or gravel pits around Rice Lake; liquids were first handled by septic tanks and then by a primary wastewater treatment plant. Built in 1939, the plant separated solids from liquids and funneled treated wastewater--still nutrient rich with household and factory wastes--down Rice Creek to Rice Lake.

For three decades the creek ran foul. And still the lake stayed clear, waterfowl flocked to its wild rice, people fished and swam its waters.

A Decade of Change

Change came in the 1970s. Wild rice declined, ducks became scarce, algae clouded the water, and people gave up fishing and swimming. Farmers recall marsh islands floating across the lake, silt filling a deep-water channel, and the lake flooding its shores.

High water levels preceded these changes. The U. S. Geological Survey found ground water at Milltown Village rose 2.2 m (7.3 ft) between 1964 and 1972, when precipitation was often above average (Engel and Nichols 1991). The U.S. Departments of Interior and Agriculture photographed Rice Lake studded with islands, the surrounding marsh under standing water, and the outlet creek running two channels in the 1970s. Although ground water dropped after 1978, beaver dams across the outlet creek kept the lake level high until 1984. Then the town removed the dams, but ground water rose again and stayed high until the 1987-89 drought.

When water levels rose, water quality fell. High water thinned wild rice beds and left spindly plants. That exposed the lake bed to wind-driven waves, uprooting the remaining rice and suspending sediment laden with wastewater nutrients. Snowmelt and rainfall washed more soil and nutrients from surrounding marsh and farms, fueling algal blooms. The turbid water probably made sight feeding difficult for the largemouth bass, bluegill, black crappie, and northern pike.

Milltown Village built a secondary wastewater treatment plant in 1979, to remove more oxygen-demanding solids. But Rice Lake had already become degraded.

Rice Lake Today

Rice Lake has yet to recover. Wind and high water from new beaver dams still tear islands from the marsh border. Suspended sediment and green algae (Chlorophyceae) still keep lake water turbid after ice-out. From winter to summer, Secchi disk transparency decreases almost 80%, from 149 cm to 34 cm (58 inches to 13 inches). Over the same period, chlorophyll *a* and water turbidity increase over 90%, from 6 to 78 μg/L and 1 to 23 NTU, respectively.

Water turbidity has altered the lake's macroscopic plant community. Although cattails and bulrushes (*Scirpus*) still border Rice Lake, water lilies (*Nymphaea* and *Nuphar*) grow where wild rice once flourished. Just 5 species grow submersed, averaging together only 28-31 g/m^2 dry weight in August. Sago pondweed (*Potamogeton pectinatus*) and floating-leaf pondweed (*P. natans*) make up over 80% of total standing crop; coontail (*Ceratophyllum demersum*), elodea (*Elodea canadensis*), and water crowfoot (*Ranunculus longirostris*) make up the remaining 20%.

Cold water and water turbidity delimit a spring (May) growth window for this community. Cold water in April delays seed and tuber development; algal blooms in June shade underwater foliage. By sprouting from food-rich tubers or rhizomes, and placing foliage at the water surface, water lilies and the dominant pondweeds avoid summer turbidity.

But water turbidity keeps even these hardy plants from growing deeper than 1.1 m (3.6 ft). They form clumps shaped like rings or loops of healthy plants surrounding interior plants smothered by silt (Engel and Nichols 1991).

Rice Lake's fish community has changed as well. Black bullhead (*Amieurus melas*) and yellow perch (*Perca flavescens*) now dominate instead of bass and bluegill. With pumpkinseed (*Lepomis gibbosus*), white sucker (*Catostomus commersoni*), and fathead minnow (*Pimephales promelas*), they constituted 95% of electrofishing (May 1988) and fyke netting (May 1990) catches.

Thickening ice cover in January, and February restricts these fish to the central two thirds of Rice Lake (Fig. 2). By February over one half of this area becomes devoid of dissolved oxygen, further restricting the fish to less than 15% of the living area present during ice-free months.

Yet such fish can avoid winterkill by moving to the spring-fed inlet or even ascending Rice Creek, which remains open and flowing all winter. This winter refuge makes turbid water in summer a more likely threat to fish survival than dissolved oxygen loss in winter.

Restoring Rice Lake

Restoration has already begun. Aquarium studies showed Rice Lake sediment can still grow a variety of aquatic plants. So we planted 3,000 wild celery tubers (*Vallisneria americana*) and, with help from the Balsam Lake Protection and Rehabilitation District, sowed 10 acres of northern wild rice in Rice Lake (Fig. 3). More rice will be sown in 1992 with help from the Great Lakes Indian Fish and Wildlife Commission. Such plantings should improve water clarity during summer by storing nutrients and stabilizing sediment that could wash downstream to Balsam Lake.

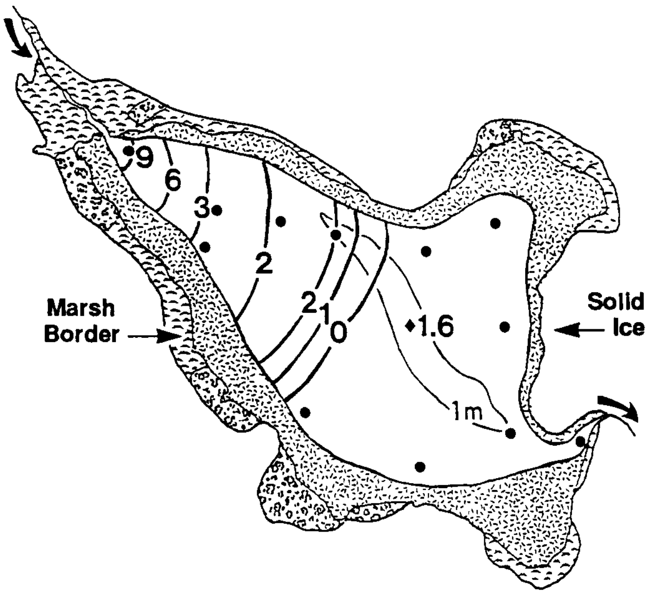

Figure 2. *Rice Lake on 21 February 1989 walled in by marsh and solid ice. Dissolved oxygen concentrations (mg/L) are indicated with heavy lines and numbers. The 1-m (3.3-ft) depth contour is indicated by a light line.*

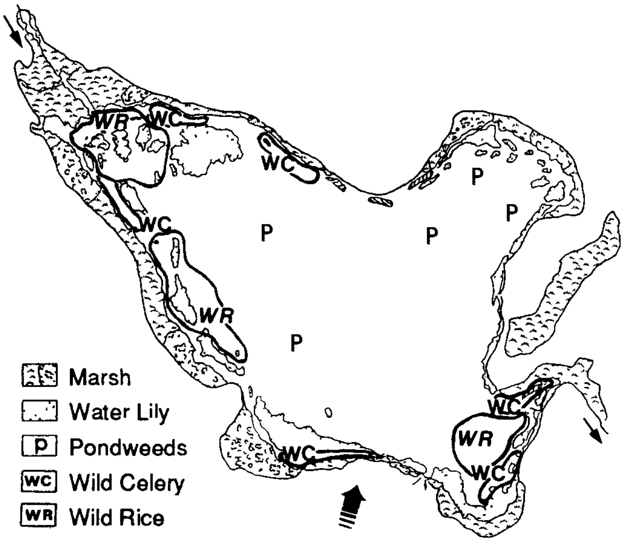

Figure 3. *Aquascaping plan for Rice Lake, showing 1991-92 plantings of wild celery tubers (May) and wild rice seeds (September). The large arrow shows prevailing summer winds from the southwest.*

Restoring Rice Lake, however, will take planning and continued teamwork. Plantings must be repeated, so a seed bank can be established. Muskrats, beavers, and bullheads must be controlled, so wild rice can grow. Wastewater treatment and land management must be improved, so fewer nutrients reach the lake. Ultimately a lake use plan must be developed to guide the restoration.

Will Rice Lake rise again? That will depend less on wind and water, less even on rice and rats, than on our commitment to work together.

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Sandy Engel is a zoologist who coordinates the Shallow Lakes Initiative, a habitat restoration effort of the Wisconsin DNR. *Address*: Woodruff Fish Hatchery, 8770 County Hwy. J, Woodruff WI 54568. *Phone:* (715)356-5211.

Stanley A. Nichols is a botanist who teaches at the University of Wisconsin-Extension and conducts research for the Extension's Wisconsin Geological and Natural History Survey. *Address*: 3817 Mineral Point Road, Madison, WI 53705. *Phone:* (608)262-6556.

Edited by Betty Les

Bureau of Research
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, WI 53707

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